*Perceptual and Motor Skills*, 1995, 80, 403-410. © Perceptual and Motor Skills 1995

# WOMEN RECONSTRUCT MORE DETAILS THAN MEN FOR A COMPLEX FIVE-MINUTE NARRATIVE: IMPLICATIONS FOR RIGHT-HEMISPHERIC FACTORS IN THE SERIAL MEMORY EFFECT [1, 2]

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*Summary.*—A total of 20 men and 20 women listened to a 5-min. ambiguous narrative (the "Billy" story). When the subjects were asked (unexpectedly) to reconstruct the details of the story as a written narrative 30 min. later, women employed about 50% more words and comparably more accurate detail than the men. Covariance for pre-experimental experiences suggested that the women's proficiency could be related to the greater representation of linguistic processes within the right (nondominant) hemisphere. The hypothesis that the classic deficit of reconstructional accuracy for events during the middle of a story is related to right-hemispheric inhibition was also supported. Subjects who recalled the fewest details reported more vivid dreaming during the subsequent two days.

If microstructure determines microfunction, then the regions of sexual dimorphism within the human brain should be associated with correlative differences in their respective functions (Persinger, 1993b). As a group, normal right-handed women exhibit more proficient linguistic processing than do groups of normal right-handed men (Kolb & Whishaw, 1990). If verbal memory for men is less accurate than it is for women, these weak effects should be amplified when demands upon neurolinguistic processes are increased. Support for this argument was reported by Makarec and Persinger (1993) who found that bilingual men (regardless of the type of second language) exhibited 20% to 50% less accurate verbal memory than did bilingual women who did not differ from either monolingual men or women.

If there is greater representation of language within the right hemisphere of the normal woman compared to the normal man (Reite, Cullum, Stocker, Teale, & Kozora, 1993; Witelson, 1991), then the general increase in accuracy of verbal memory for women could be associated with additional input from the nondominant hemisphere. Covariance for experiences which are inferred, based upon theory or empirical observations, to be associated with right-hemispheric processes should attenuate these sex differences. The present experiment was designed to test this hypothesis. We selected a narrative, the "Billy Story" (Dittburner & Persinger, 1993), be-

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cause it contains ambiguous, emotional themes to which the more affectively loaded right hemisphere should respond.

## Method

To test this hypothesis 20 men and 20 women volunteered to participate in a "relaxation" experiment to obtain a 2% bonus for their final grades in a first-year arts course; the ages of the participants ranged between 20 and 25 years. Each subject had completed the Personal Philosophy Inventory (PPI), within a portion of the class period reserved for psychometric testing, approximately two months before the experiment began (89% of the subjects reported they used the right hand for writing). The various clusters of experiences (Persinger & Makarec, 1987, 1993), inferred to reflect complex partial epileptic-like signs, were extracted from the computer files for each subject after the experiment had been completed.

On the day of the experiment each subject sat in a comfortable chair within a commercial acoustic chamber. After goggles had been placed over the eyes and the technician left the chamber and closed the door, a 5-min., taped story was played through the chamber speakers. The "Billy Story" (Dittburner & Persinger, 1993) is a narrative in which is described the circumstances surrounding a small boy's anomalous nocturnal episode. Thirty minutes later, the goggles were removed, the chamber lights were activated, and the subject was asked to recall the story and to write all of the details that had occurred. Two days later, each subject was called by the person who served as the experimenter and was asked if the subject had experienced any unusual vivid dreams since leaving the chamber. This procedure has been included in the protocol because of the numbers of reports of "vivid dreams" and left peripheral-field anomalies (primarily phosphenes or sensed presences) by some of our clinical patients during the night following the field exposures. This specific anistropic occurrence of visual sensations within the upper-left quadrant of the peripheral field is predicted because the applied fields should encourage poststimulatory electrical lability within Meyer's loop of the *right* temporooccipital region.

The narratives were transcribed and total numbers of words employed were determined automatically by the spelling software of the word processor (Word Perfect). The ideas, actions, and objects within the story were then partitioned in a manner similar to the partitioning provided in the scoring procedure of the Wechsler Memory Scales (Wechsler, 1973). The story was divided into five successive (1-min.) segments; each segment's maximum score was between 50 and 54. The first part of the analyses involved the percentage of total ideas which were recalled and the numbers of words which were written by subjects of each gender before and after covariance for indicators of complex partial epileptic-like signs and left- and right-hemispheric indicators had been completed. The second part of the analyses

was designed to examine which portion of the story was primarily responsible for the difference. All analyses involved SPSS software on a Vax 4000 computer.

## Results

The results supported the hypothesis. The women recalled about 50% more (accurate) details than did the men. The means and the standard deviations for the total numbers of words written in the narratives were 284 and 99, respectively, for the women and 193 and 92, respectively, for the men ($F_{1,38} = 9.05$, $p < .01$, $eta = 0.44$). To accommodate for the potential range distortion, square root transformations were completed; the gender effect was still evident ($F_{1,38} = 8.29$, $p < .01$; $eta = 0.42$). Women also exhibited more accurate reconstruction of the story than did the men as defined by the percentages of scores for total ideas, actions, objects, and phrases (men: $M = 44.7$, $SD = 25.5$; women: $M = 65.8$, $SD = 21.9$; $F_{1,38} = 7.84$, $p < .01$; $eta = 0.41$). However, the ratio of total numbers of words per total numbers of correct ideas for the narrative did not differ significantly ($F_{1,38} = 0.23$; grand $M = 4.4$; $SD = 0.8$) between the men and the women. We concluded that the women's greater verbal (written) fluency was also associated with the greater accuracy of the number of recalled details.

One-way analyses of variance were employed to assess gender differences on the key scales and clusters from the Personal Philosophy Inventory which were central to this hypothesis. There were no statistically significant gender differences (all scores represent percentages of endorsed items per cluster) between men and women (grand mean and standard deviations indicated in parentheses) for scores on the control cluster ($76 \pm 10$) and the major cluster of complex partial epileptic-like signs ($32 \pm 17$) and for scores for clusters that were constructed by smaller numbers of items (4 to 6): religious beliefs ($41 \pm 30$), liberal or exotic beliefs ($45 \pm 25$), automatic behaviors ($43 \pm 37$), verbal meaningfulness ($25 \pm 38$), widened affect ($46 \pm 26$), auditory-vestibular experiences ($31 \pm 24$), or a history of a sensed presence ($18 \pm 25$).

However, women, compared to men, reported significantly (all *df*s = 1,38) higher scores for fears ($F = 14.15$, $p < .001$), paranormal experiences ($F = 7.90$, $p < .01$), writing preference (e.g., diaries; $F = 7.18$, $p < .01$), and olfactory experiences ($F = 4.84$, $p < .05$). The means and *SD*s for each of these clusters for men and women, respectively, were for fear 32 ($SD = 17$) and 58 ($SD = 24$), paranormal experiences 21 ($SD = 16$) and 44 ($SD = 24$), writing preference 13 ($SD = 23$) and 40 ($SD = 37$), and olfaction 11 ($SD = 21$) and 27 ($SD = 24$). The coefficient of variation for each of these clusters was similar to that for the general population of university students during the last 10 years and was influenced by the wide range of individual variation in con-

junction with the small numbers of items for the smaller phenomenological clusters.

Covariance before the analysis of variance for each of the variables specified above did not alter the effect size for either the total numbers of words (*eta* values between 0.42 and 0.49) or the square root of the total numbers of words (*eta* values between 0.40 and 0.46). The only exception was for the numbers of parapsychological experiences. After covarying for this cluster of items, the effect sizes for the gender differences on the total numbers of words ($eta = 0.35$) and square root of the total numbers of words ($eta = 0.32$) were reduced, and the latter was no longer statistically significant. We (Persinger, 1993a, 1993b) have suggested that the processes associated with these experiences, regardless of their ultimate veridicality, are derived from highly affective right-hemispheric processes which must intercalate with and be transformed into left-hemispheric and linguistic images to be experienced as declarative memory.

Table 1 contains the means and standard deviations for the percentages of recalled components for each of the five segments of the Billy story for the men and for the women. *Eta* values, to indicate effect size, are also shown. The major source of the gender effect (as defined by the statistical significance and strength of the eta values) was associated with the descend-

TABLE 1
MEANS AND STANDARD DEVIATIONS FOR PERCENTAGE OF CORRECT IDEAS FOR FIVE SUCCESSIVE SEGMENTS OF A 5-MIN. COMPLEX NARRATIVE

| Sequence | Men ($n = 20$) | | Women ($n = 20$) | | *eta*‡ | *eta'* |
|---|---|---|---|---|---|---|
| | *M* | *SD* | *M* | *SD* | | |
| 1 | 21 | 13 | 25 | 11 | .19 | .11 |
| 2 | 18 | 16 | 28 | 17 | .33* | .25 |
| 3 | 16 | 9 | 23 | 10 | .42† | .40* |
| 4 | 10 | 10 | 13 | 08 | .13 | .12 |
| 5 | 18 | 14 | 30 | 14 | .40* | .40* |

*$p < .05$. †$p < .01$.
‡*Eta* values before and after (*eta'*) covariance for a history of paranormal experiences are indicated.

ing portion of the traditional primacy component of the curve and with the last (recency) component of the serial effect. Covariance for the numbers of paranormal experiences reduced the eta values for these three components and eliminated the statistical sequence of Segment 2 but not those of either Segments 3 or 5. To ensure that the nonlinear effects (being interpreted as reflective of a serial memory effect) were not an artifact of the emotional meaning of the words which composed the segments, the Whissell Dictionary of Affect in Language (Whissell, 1989) was completed for the words in each of the 10 successive, 30-sec. increments which composed the five seg-

ments of the story. The means and standard deviations (*SD* in parentheses) for the unpleasantness-pleasantness and the passive-active dimensions for the entire story were 4.60 (0.27) and 3.94 (0.31), respectively; except for Segment 2, which would have been in Part 1 of our analyses, all scores for each of the nine other increments were within ±1.5 *SD*s of the mean for all 10 segments. Neither the magnitude nor the level of statistical significance was altered appreciably when the four left-handers (two men, two women) were excluded from the analysis.

A total of six (four men and two women) of the 40 subjects reported inordinate dreaming following the experiment. Point-biserial correlation between the numbers of accurate components of the story and the report of this dreaming was 0.40; stated alternatively, those subjects who reported the least accurate recall or the fewest numbers of total words for the narrative later reported the most intense dreaming. Point-biserial correlations for the proportion of accurately recalled components for each of the five segments of the story and the report of dreaming were −.17, −.25, −.33 ($p = .02$), −.18, and −.24, respectively (correlations for all segments except the third were not statistically significant, i.e., $p > .05$). These results suggested that subjects who recalled the least content of the middle portion of the story reported more intense dreams; however, the content of the dreams was not recorded.

We suggest the following hypotheses to accommodate the results of this study. The significantly more proficient (accurate) reconstruction of details which is displayed by the women, compared with the men, within 30 min. after the exposure to a 5-min. narrative reflects an intrinsic feature of the normal female brain. The proficiency, which is not an artifact of simple verbal fluency or prolixity, is more evident for narratives when they contain themes and emotional (affective) implications which allow the contribution of emotional meanings to the reconstruction of the narrative sequence. If the setting were contextual such as in the present experiment, then the translation of the affective memory into the originally associated verbal and categorical images would be enhanced.

However, if the setting during the reconstruction were noncontextual, the categorical accuracy could decrease and the numbers of inferential conclusions (which would be affectively correct while the images would be less correct for both details and semantic category) would increase (Persinger & Richards, 1994). This prediction is compatible with the inferences of Kimura (1987) that linguistic processes are more dominated by prefrontal cortical functions for women relative to men. If this conclusion is generalizable, then the prefrontal cortical functions of *organization, differentiation of classes of experiences*, and *reconstruction* could preferentially affect women's speech and verbal memory. When these left prefrontal processes are not optimal such as during psychological depression, inclusions of dreams and images

from more recently acquired experiences (such as books that emphasize metaphor more than fact) into episodic and autobiographical memory would be more probable.

The basis for this additional source of reconstructional process originates primarily in the normal woman's nondominant (right) hemisphere which contains a slightly but significantly more linguistic representation than the right hemisphere of the normal right-handed man (Annett, 1991; Witelson, 1991); however, this additional linguistic input from the right hemisphere is more strongly affected by the emotional dimensions of the words. Psychometric removal of a major although inferred source of variance which is associated with enhanced intercalation of the left hemisphere with a right-hemispheric property, i.e., more frequent episodes of reported (remembered) parapsychological experiences (Persinger, 1993b), reduced the size of the gender difference for the accuracy of the reconstruction of this narrative.

Such attenuation supports the hypothesis that the enhanced proficiency for the reconstruction of this affective narrative is dependent upon a process which also allows interhemispheric intercalation that in turn facilitates the report of a history of paranormal experiences. Our previous model predicts a greater incidence of intrusions of the right-hemispheric equivalents of the left-hemispheric processes that generate the sense of self (Persinger, 1993a) in women because the microstructural differences in the major fiber systems (anterior commissure and corpus callosum) encourage interhemispheric intercalation (Corsi-Cabrera, Herrera, & Malvido, 1989; de Lacoste-Utamsing & Holloway, 1982).

From this perspective, the repeated observation that women report more paranormal experiences than do normal men (Persinger, 1974) may be a genotypic microstructural factor and may not necessarily be totally dependent upon social roles or cultural encouragement. That the shared variance for the proportion of (historical) paranormal experiences and the number of reconstructed ideas were not artifacts of the increased averages of both measures for the women relative to the men was indicated by the minimal effect of scores for experiences of fear (phobias) or preference to write (which were also significantly more elevated for the women compared with the men) upon the gender differences for the memory scores.

Present results also suggest that the classic deficiency for reconstruction of verbal (linguistic) events within the middle of a serial-memory task (Wright, Santiago, Sands, Kendrick, & Cook, 1985) may be more than the occurrence of two separate processes for primacy and recency (Sommerhoff, 1974). We propose a more general and parsimonious hypothesis derived from the interdisciplinary observation that every event or process is associated with a vectorial opposite; one representation in psychology is Hull's concept of reactive inhibition (1943). Because linguistic processing of this

type of narrative involves protracted left-hemispheric processing, inhibitory contributions from the right-hemispheric analogue should increase over time (the serial order of the story) and be reflected as the trough of the negatively accelerating curve.

The largest contribution from the right-hemispheric homologue would occur during the latter portion of the primacy process—in this instance after approximately 120 major conceptual bits. Because the right-hemispheric homologue would involve much less linguistic potential but significantly more affective storage capacity, the information would be coded within this format. Consequently, the subjective correlates of this homologue would be reflected whenever this right-hemispheric process predominates such as during dreams (if Gordon's 1991 hypothesis is valid). The observation that those subjects who had reported unusually intense dreams had recalled the fewest details of the middle segment of the narrative would support this contention. Unfortunately this is a weak argument because we did not ask the subjects to report the details of the dreams due to the restraints of the protocol.

The obvious prediction of this model is that normal people, particularly women, should display the greatest accuracy for words which contain the more extreme polarities of the pleasantness-unpleasantness and passive-activity dimensions of emotional meaning (Whissell, 1989) if these words are presented within the middle segments of a complex and emotive serial-learning task. The second prediction is that women compared with men should exhibit (during reconstruction of word sequences which emphasize emotional meaning) more frequent substitutions with words or images which share similar affective dimensions although the categorical characteristics may not be related. Most serial-memory tasks, following the tradition of Ebbinghaus, have shorn the dimension of emotional meaning and interactive syntax from linguistic sequences and have emphasized unrelated words. The possibility that reconstruction of word chains which are functionally associated with syntactic-emotional patterns, e.g., narratives and stories, could invoke more representation of right-hemispheric processes within the "recall" of themes, and details for verbal memory must still be considered.

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*Accepted January 24, 1995.*